General Chemistry HW 2

1. Calculate the mass percent of oxygen in ascorbic acid (vitamin C) $C_6H_8O_6$.

2. A compound composed of carbon, hydrogen, and oxygen was analyzed. When 0.1500 g of this compound was burned with excess oxygen, 0.2200 g of carbon dioxide (CO_2) and 0.0900 g of water (H_2O) were produced.

Assuming all the carbon in the compound is converted to CO_2 and all the hydrogen in the compound is converted to H_2O, determine the mass of carbon and hydrogen originally present in the 0.1500 g sample. Determine the empirical formula of the unknown compound.

3. Balance the following chemical equation:

$$C_7H_5(NO_2)_3 + O_2 \rightarrow CO_2 + H_2O + N_2$$

4. In the unbalanced reaction between 16 moles of iron and 10 moles of oxygen to form iron(III) oxide:

$$Fe + O_2 \rightarrow Fe_2O_3$$

a) What is the limiting reactant?

b)How many moles of Fe_2O_3 will be produced?

5. Three separate cups of water are filled with strong electrolytes, weak electrolytes, and nonelectrolytes. A wire is attached to the liquid and a current is passed through. The bottom of the lightbulb is placed in the water. When a current is run through the wires, which cup will have the brightest bulb and why?

6. Match the following scenarios with their respective reaction types (neutralization, precipitation, combustion, redox):

a. Mixing solutions of sodium sulfate and barium chloride, resulting in a white solid forming.
b. Using baking soda to neutralize vinegar in a DIY volcano.
c. Burning charcoal in a barbecue grill to cook food.
d. A battery powering a flashlight.

7. Calculate the number of moles of Cl^- in 1.75 L of 1.0×10^{-3} M $ZnCl_2$.

8. Blood serum contains about 0.14 M NaCl. What volume of blood contains 1 mg of NaCl?

9. How much 2 M NaCl solution is needed to prepare 250 mL of 0.5 M NaCl solution?

10. A laboratory technician has 100 mL of a 3 M phosphoric acid stock solution and wants to dilute it to 1 L. What will the final molarity of the solution be?

11. Calculate the mass of solid NaCl that must be added to 1.50 L of 0.100 M $AgNO_3$ solution to precipitate all the Ag^+ ions in the form of AgCl.

12. What volume of 0.150 M H_2SO_4 solution is needed to neutralize 40.0 mL of 0.200 M $Al(OH)_3$?

13. Determine the oxidation states of each atom in the following molecules:

a. **HCl**

b. **CO_2**

c. **Na_2O**

d. **$Mg(OH)_2$**

14. Iron(II) ions react with dichromate ions in <u>acidic</u> solution.

$$Fe^{2+}_{(aq)} + Cr_2O_7^{2-}{}_{(aq)} \rightarrow Fe^{3+}_{(aq)} + Cr^{3+}_{(aq)}$$

a. **Identify the oxidizing and reducing agents.**

b. **Write the balanced oxidation half reaction.**

c. **Write the balanced reduction half reaction.**

d. Write the overall balanced reaction.

15. Zinc reacts with nitrate ions in a <u>basic</u> solution.

$$Zn_{(s)} + NO_3^-{}_{(aq)} \rightarrow Zn(OH)_4^{2-}{}_{(aq)} + NH_{3(aq)}$$

a. Identify the oxidizing and reducing agents.

b. Write the balanced oxidation half reaction.

c. Write the balanced reduction half reaction.

d. Write the overall balanced reaction.